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WATER STANDARDS AND STUDIES, REPORT #84-1

ABSTRACT

Brown, D. J. 1984. Bibliography of Water Standards and Studies Section Publications, 1983. Environmental Management Division. Water Standards and Studies Report #84-1. 20pp.

The Water Standards and Studies Section, Environmental Management Services Branch, Manitoba Department of Environment and Workplace Safety and Health, produced twenty-four reports. In 1983 one additional report was produced jointly with the Terrestrial Standards and Studies Section.

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INTRODUCTION

The reports listed in this document were prepared by staff of the Water Standards and Studies Section, Environmental Management Services Branch of the Manitoba Department of Environment and Workplace Safety and Health. Each report was distributed by the Department as it became available. Enquiries for copies should be directed to the following:

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REPORTS

REPORT 83-1 Brown, D. J. (1983). Bibliography of Water Standards and Studies Section/Publications, 1982. Environmental Management Division. May 1983. 17pp.

In 1982, The Water Standards and Studies Section, Environmental Management Services Branch, Department of Environment and Workplace Safety and Health, produced thirty-one reports, one audio-visual program and contributed to a second audio-visual program/produced by Environmental Standards and Studies.

REPORT 83-2 Williamson, D. A. (1983). Surface Water Quality Management Proposal. Volume 1: Surface Water Quality Objectives. Environmental Management Division. October 1983. 41pp.

SUMMARY

The surface waters of Manitoba are used for numerous purposes including domestic consumption, industrial uses and agricultural purposes such as irrigation and livestock watering. In addition, many surface waters are used for recreational pursuits such as swimming, water skiing, boating and the enjoyment of pleasant scenery. Most waters are also inhabited by fish life, amphibians (frogs), reptiles (turtles), aquatic insects and algae. Large forms of wildlife, small furbearing mammals, water fowl and some birds of prey rely upon surface waters for drinking purposes, habitat and sources of food supplies.

The quality of surface water has the potential to become degraded through many other uses such as the disposal of industrial and municipal effluents, development of hydroelectrical generating sites and land use practices such as agriculture and forestry.

In order to achieve harmony between the various uses, surface water quality objectives were developed which define minimum levels of quality for each of the uses that requires protection. The objectives, when not exceeded, will protect an organism, a community of organisms, a prescribed water use, or a designated multiple purpose water use with an adequate degree of safety. Specific objectives have been developed for over eighty substances.

These objectives affect all Manitobans, since, if they are under protective, surface water quality may become degraded, or if they are over protective, an unnecessary burden may be imposed on taxpayers and industry in order to pay for additional waste treatment facilities.

Surface water quality objectives are primarily used by government agencies, such as the Environmental Management Division and the Clean Environment Commission, in order to assist in developing effluent discharge restrictions for industrial and municipal waste discharges. In addition, other government agencies may use the objectives to control land use practices that may have effects on water quality, such as cottage development.

The objectives are also used by the Environmental Management Division, in combination with environmental monitoring programs, to determine if pollution control measures are successful in preventing water pollution. For example, the objectives may be used to determine if the waste treatment provided by a municipal sewage lagoon is successful in preventing water pollution of a fish spawning stream.

The objectives are also used by other government agencies to determine if certain waters are suitable for uses such as irrigation.

If the objectives are exceeded, there is no direct legal recourse to the source of the pollution. However, the Environmental Management Division may conduct the necessary studies in order to determine the cause of the pollution. Should the cause be waste effluents, Clean Environment Commission Orders may be reviewed and revised in order to provide the necessary protection.

Occasionally, water quality parameters may exceed these objectives due to natural conditions. In these cases, the objectives do not apply. It is the intent that these objectives are applicable to conditions in the water that are caused by man's activities. However, if a certain parameter exceeds the objectives due to natural conditions, it would be unwise to further increase that parameter by man-made activities.

It is important to realize that scientific information is limited on all the possible effects of a pollutant in the environment. New information, however, is continually being reported. Thus, the objectives must be revised periodically in order to include the most recent scientific knowledge. Based upon the available information, these objectives are designed to afford adequate protection without an unreasonable amount of over protection or under protection.

Thousands of substances could potentially pollute Manitoba's surface waters. These include, for example, agricultural chemicals, or hazardous goods that may be transported through Manitoba. Objectives have not been developed for all possible substances that could affect water quality. However, given reasonable information that such substances are present, objectives will be developed using the best available scientific information.

Because specific numerical objectives cannot reasonably be developed for every possible chemical, physical or biological parameter, general statements concerning environmental quality are also used to protect water quality. These requirements, although written in general terms, are nevertheless water quality objectives. For example, these may be used to establish effluent limits even though there may be no specific numerical objectives applicable in the receiving water. General statements have been developed for colour, odour, taste, turbidity, deposits, floating materials, flow, litter, nutrients, oil and grease and toxic substances.

Ideally, objectives should be maintained at all times. It is however, generally accepted that to require objective maintenance at all times is unreasonable. Thus, a specific low flow level has been chosen below which the objectives do not have to be met. This flow, for large streams and rivers, is the lowest flow which, on a statistical basis, would occur for a seven consecutive day period once every ten years. For small intermittent streams this minimum flow is $0.003 m^3/s$. The objectives should be maintained at all times in lakes.

Mixing zones are areas adjacent, for example, to a discharge, where the stream or lake may not meet all the water quality objectives. This is allowed for practical reasons, since for most contaminants, it would be unreasonable to expect the objectives to be met at the end of the discharge pipe. Mixing zones are therefore recognized as areas subject to a loss of value, but nevertheless, certain guidelines should be followed to ensure that the loss is kept as small as possible. These include, for example, ensuring that the entire width of rivers are not completely influenced by a discharge in such a manner that fish movement is prohibited or that bathing areas are not included in mixing zones.

Certain pristine waters support important major uses, such as recreation on surface waters within Provincial Parks. These waters may be given a "High Quality" designation. It is the intent that discharges or other activities that may affect the water quality of these areas should be very strictly controlled. Thus, development within "High Quality" surface water areas will likely be more costly than in other areas of the Province, since all available measures should be used to control environmental disturbances.

Some pristine waters of the Province may be preserved in their natural state for the future. These waters will be given an "Exceptional Value" designation. Development of any type that may affect water quality should be discouraged from these areas.

Objectives have been developed for each of the general surface water uses within Manitoba that requires protection. These are designated as classes and include domestic consumption, aquatic life and wildlife, industrial consumption, agricultural consumption, recreation and other uses. Where possible, these general classes are further divided into categories to provide protection, for example, to the different types of recreation.

CLASS 1: DOMESTIC CONSUMPTION will ensure the protection of waters that are suitable for human consumption after treatment. Since all surface waters of Manitoba are susceptible to uncontrolled microbiological contamination, for example, by wildlife, minimum treatment consisting of disinfection is required for all surface waters prior to consumption. Objectives are included for substances that may have harmful health effects, such as pesticides, toxic metals and radioactive materials and for substances that may present a nuisance to the consumer, such as excessive hardness and iron.

CLASS 2: AQUATIC LIFE AND WILDLIFE will ensure the protection of waters that are suitable for aquatic life such as fish, amphibians (frogs), reptiles (turtles) and other forms of life including aquatic insects and algae. By ensuring protection of the aquatic communities, protection is indirectly offered to those forms of wildlife that rely upon surface waters for habitat and for food supplies. These include ducks, geese, furbearing mammals such as the muskrat and birds of prey such as the eagle and osprey. Protection is also provided to those animals that use these waters for drinking purposes.

Objectives are included for numerous parameters including dissolved oxygen, toxic metals and pesticides. The presence of dissolved oxygen in water is essential for aquatic life, and the type of aquatic community is dependent to a large extent on the amount of dissolved oxygen present. Toxic metals, such as zinc and cadmium, in small concentrations, can have harmful effects on growth and reproduction, and in large concentrations, can be lethal. Others, such as mercury and PCB's, even though present in small quantities, can slowly bio-accumulate in the tissue of organisms, until higher harmful levels are reached.

Some metals, such as cadmium, are more or less toxic depending upon the hardness of the water. For this reason, a mathematical equation is used to establish an objective based upon the relationship between toxicity and hardness.

The existence and composition of an aquatic community also depends upon temperature characteristics. An excessive increase in temperature can be harmful by interfering with fish spawning cycles, causing changes in growth and respiration, and causing more heat tolerant species to replace heat sensitive ones. Heat related winter fish kills can occur when a heated discharge is suddenly stopped. Fish that have been attracted to a heated area are suddenly exposed to the cold ambient temperature.

Developing site-specific temperature objectives is complicated and time consuming. Therefore, a method is included by which temperature objectives will be developed for specific discharges.

CLASS 2: AQUATIC LIFE AND WILDLIFE is subdivided into two categories in order to provide specific protection to different general groups of aquatic life in Manitoba.

CATEGORY A: COLD WATER AQUATIC LIFE, COOL WATER AQUATIC LIFE AND WILDLIFE will provide protection to all types of aquatic life inhabiting the surface waters of Manitoba, including the protection of wildlife.

CATEGORY B: COOL WATER AQUATIC LIFE AND WILDLIFE will provide protection to cool water aquatic life such as walleye, sauger and pike, including the protection of wildlife. This category, however, will not provide adequate protection to cold water aquatic life such as trout and whitefish.

CLASS 3: INDUSTRIAL CONSUMPTION will ensure the protection of waters that are used for industrial purposes. However, objectives will not be developed at present due to the large number of present and potential industrial users, each with different quality requirements for water.

CLASS 4: AGRICULTURAL CONSUMPTION will provide protection to waters used by the market garden and farming industry for irrigation and livestock watering purposes. Objectives are included for parameters, such as sodium, that will protect various textured soils. Other objectives, such as boron, will protect sensitive plants. In addition, others, for example, fecal coliform bacteria are included that are intended to protect humans following consumption of raw vegetables irrigated with waters of this class.

This class is subdivided into four categories in order to provide protection to three different general irrigation practices plus to provide protection for livestock watering.

CATEGORY A: IRRIGATION will provide protection to waters that are used by the greenhouse industry where such water is the only source of moisture for the greenhouse plants.

CATEGORY B: IRRIGATION will provide protection to waters that are used to irrigate field crops, where such water is used to supplement natural rainfall.

CATEGORY C: IRRIGATION will provide protection to waters that are used to irrigate field crops, where such water is used to supplement natural rainfall. These waters, however, may damage certain soil types if used for long periods of time.

CATEGORY D: LIVESTOCK will provide protection to waters that are used by livestock.

CLASS 5: RECREATION will ensure that surface waters may be safely used for swimming and boating purposes and also may provide for the enjoyment of pleasant scenery. These waters provide outdoor recreational opportunities for both Manitoba residents and for tourists.

This class is further subdivided into two categories in order to provide protection to the different types of water related recreation depending upon the extent of contact with the water.

CATEGORY A: PRIMARY RECREATION will ensure the protection of waters that may be used for purposes such as swimming and water skiing, where contact with the water is an important aspect of the activity.

CATEGORY B: SECONDARY RECREATION will ensure the protection of waters that may be used for purposes such as fishing and boating, where contact with the water is only incidental to the activity.

Manitoba's surface waters may be used for other purposes that do not require protection through the establishment of objectives. These include, for example, the disposal of wastes or the generation of hydroelectrical power. Because of social or economic reasons, certain waters may be used only for these uses. Such waters may be given a **CLASS 6: OTHER USES** classification.

REPORT 83-3 Williamson, D. A. (1983). Surface Water Quality Management Proposal. Volume 2: Watershed Classifications. Environmental Management Division. October 1983. 6pp.

SUMMARY

Watershed Classification is a process through which uses are identified for bodies of water, then objectives are applied that will protect those uses. For example, through this process it may be determined that it is desirable to maintain certain lakes or rivers for drinking purposes or for recreational activities. The objectives that will protect these uses (from Volume 1 of this document) are then applied.

The Province of Manitoba has been divided into nineteen natural watersheds. Each watershed will be classified individually.

Watershed classification is a complex process that involves input from numerous government agencies, industries, municipalities and most important, from private citizens.

Information must be analyzed in order to determine the present and potential uses of certain bodies of water, how the uses are affected by water quality and the social or economic value of each use. This information is organized by the Environmental Management Division in the form of a Watershed Classification Proposal.

The Clean Environment Commission then holds public hearings in order for all interested parties to participate in the further development of this proposal.

Following completion of this classification proposal to the satisfaction of the elected provincial representatives, it is the intent that all government agencies should use this classification as policy when dealing with matters related to water quality.

Because watershed classification is a lengthy process, the majority of Manitoba's waterways have yet to be classified. Therefore, surface water quality objectives from Volume 1 of this document should be applied on a site specific basis in order to protect the present uses of such watersheds. For example, when considering restrictions on a discharge within a watershed that has not been classified, and it is known that such waters are used for drinking purposes, the objectives for domestic consumption should be used in order to provide adequate protection.

REPORT 83-4 Withdrawn.

REPORT 83-5 Hughes, C. (1983). A Report on the Trophic Status of Falcon Lake, Whiteshell Provincial Park (1978-1982). Environmental Management Division. May 1983. 12pp.

SUMMARY

This report was prepared as part of the "Public Participation Program". Chlorophyll 'a' and Secchi disc data for 1978 to 1982 were presented. The 1982 chlorophyll and transparency results were indicative of low algae populations and good water clarity, respectively. The 1982 results were compared to other years and other Whiteshell Provincial Park lakes. Trophic state indices (TSI) indicated that Falcon Lake was mesotrophic in nature.

REPORT 83-6 Hughes, C. (1983). A Report on the Trophic Status of Betula Lake. Whiteshell Provincial Park. (1978-1982). Environmental Management Division. May, 1983. 12pp.

SUMMARY

This report was prepared as part of the "Public Participation Program" Chlorophyll 'a' and Secchi disc data for 1978 to 1982 were presented. The 1982 chlorophyll and transparency results were indicative of moderate algae populations and low water clarity, respectively. The 1982 results were compared to other years and other Whiteshell Provincial Park lakes. Trophic state indices (TSI) indicated that Betula Lake was eutrophic in nature.

REPORT 83-7 Hughes, C. (1983). A Report on the trophic Status of Star Lake, Whiteshell Provincial Park. (1979-1982). Environmental Management Division. May, 1983. 11pp.

SUMMARY

This report was prepared as part of the "Public Participation Program". Chlorophyll 'a' and Secchi disc data for 1979 to 1982 were presented. The 1982 chlorophyll and transparency results were indicative of low algae populations and moderate water clarity, respectively. The 1982 results were compared to other years and other Whiteshell Provincial Park lakes. Trophic state indices (TSI) indicated that Star Lake was mesotrophic to eutrophic in nature.

REPORT 83-8 Hughes, C. (1983). A Report on the Trophic Status of Red Rock Lake, Whiteshell Provincial Park. (1978-1982). Environmental Management Division. May, 1983. 12pp.

SUMMARY

This report was prepared as part of the "Public Participation Program". Chlorophyll 'a' and Secchi disc data for 1978 to 1982 were presented. The 1982 chlorophyll and transparency results were indicative of moderate algae populations and moderate water clarity, respectively. The 1982 results were compared to other years and other Whiteshell Provincial Park lakes. Trophic state indices (TSI) indicated that Red Rock Lake was mesotrophic to eutrophic in character.

REPORT 83-9 Hughes, C. (1983). A Report on the Trophic Status of West Hawk Lake, Whiteshell Provincial Park. (1978-1982). Environmental Management Division. May, 1983. 12pp.

SUMMARY

This report was prepared as part of the "Public Participation Program". Chlorophyll 'a' and Secchi disc data for 1978 to 1982 were presented. The 1982 chlorophyll and transparency results were indicative of low algae populations and good water clarity, respectively. The 1982 results were compared to other years and other Whiteshell Provincial Park lakes. Trophic state indices (TSI) indicated that West Hawk Lake was oligotrophic to mesotrophic in nature.

REPORT 83-10. Hughes, C. (1983). A Report on the Trophic Status of the South Basin of Lake Winnipeg. (1980-1982). Environmental Management Division. May, 1983. 10pp.

SUMMARY

This report was prepared as part of the "Public Participation Program". Chlorophyll 'a' and Secchi disc results for 1980, 1981 and 1982 were indicative of high algae populations and low water clarity, respectively. Trophic state indices (TSI) indicated that the south basin of Lake Winnipeg was eutrophic in nature.

REPORT 83-11. Hughes, C. (1983). A Report on the Trophic Status of Bird, Beresford, Booster and Long Lakes. (1981-1982). Environmental Management Division. May, 1983. 12pp.

SUMMARY

This report was prepared as part of the "Public Participation Program". Chlorophyll 'a' results for 1982 were indicative of low to moderate algae populations on Beresford, Bird, Booster and Long lakes. Secchi disc results for 1982 were indicative of fair water clarity in Beresford Lake and moderately good to good water clarity in Bird, Booster and Long Lakes. Trophic state indices (TSI) indicated that all four lakes were mesotrophic to eutrophic in character.

REPORT 83-12. Hughes, C. (1983). A Report on the Trophic Status of Brereton Lake Whiteshell Provincial Park. (1978-1982). Environmental Management Division. May, 1983. 12pp.

SUMMARY

This report was prepared as part of the "Public Participation Program". Chlorophyll 'a' and Secchi disc data for 1978 to 1982 were presented. The 1982 chlorophyll and transparency results were indicative of moderately high algae populations and relatively poor water clarity, respectively. The 1982 results were compared to other years and other Whiteshell Provincial Park lakes. Trophic state indices (TSI) indicated that Brereton lake is eutrophic in nature.

REPORT 83-13 Hughes, C. (1983). A Report on the Trophic Status of White Lake, Whiteshell Provincial Park. (1978-1982). Environmental Management Division. May, 1983. 12pp.

SUMMARY

This report was prepared as part of the "Public Participation Program". Chlorophyll 'a' and Secchi disc data for 1978 to 1982 were presented. The 1982 chlorophyll and transparency results were indicative of moderate algae populations and moderate water clarity, respectively. The 1982 results were compared to other years and other Whiteshell Provincial Park lakes. Trophic state indices (TSI) indicated that White Lake was mesotrophic in nature.

REPORT 83-14 Hughes, C. (1983). A Report on the Trophic Status of Big Whiteshell Lake, Whiteshell Provincial Park. (1978-1982). Environmental Management Division. May, 1983. 12pp.

SUMMARY

This report was prepared as part of the "Public Participation Program". Chlorophyll 'a' and Secchi disc data for 1978 to 1982 were presented. The 1982 chlorophyll and transparency results were indicative of nuisance algae populations and moderate water clarity, respectively. The 1982 results were compared to other years and other Whiteshell Provincial Park lakes. Trophic state indices (TSI) indicated that Big Whiteshell Lake was eutrophic.

REPORT 83-15 Hughes, C. (1983). A Report on the Trophic Status of Jessica Lake, Whiteshell Provincial Park. (1978-1982). Environmental Management Division. May, 1983. 12pp.

SUMMARY

This report was prepared as part of the "Public Participation Program". Chlorophyll 'a' and Secchi disc data for 1978 to 1982 were presented. The 1982 chlorophyll and transparency results were indicative of moderately high algae populations and moderately poor water clarity, respectively. The 1982 results were compared to other years and other Whiteshell Provincial Park lakes. Trophic state indices (TSI) indicated that Jessica Lake is mesotrophic to eutrophic in nature.

REPORT 83-16 Hughes, C. (1983). A Report on the Trophic Status of Caddy Lake, Whiteshell Provincial Park. (1978-1982). Environmental Management Division. May, 1983. 11pp.

SUMMARY

This report was prepared as part of the "Public Participation Program". Chlorophyll 'a' and Secchi disc data for 1978 to 1982 were presented. The 1982 chlorophyll and transparency results were indicative of moderate algae populations and moderate water clarity, respectively. The 1982 results were compared to other years and other Whiteshell Provincial Park lakes. Trophic state indices (TSI) indicated that Caddy Lake is mesotrophic to eutrophic in nature.

REPORT 83-17 Hughes, C. (1983). A Report on the Trophic Status of Six Lakes on the Winnipeg River. (1979-1982). Environmental Management Division. May, 1983. 16pp.

SUMMARY

This report was prepared as part of the "Public Participation Program". Chlorophyll 'a' and Secchi disc data for 1979 to 1982 were presented. The 1982 chlorophyll and transparency results were variable within the Winnipeg River system but tended toward moderate algae populations and moderate water clarity. Trophic state indices (TSI) indicated that the lakes on the Winnipeg River system were mesotrophic to eutrophic in nature.

REPORT 83-18 Hughes, C. (1983). A Report on the Trophic Status of Florence and Marion Lake, Whiteshell Provincial Park. (1981-1982). Environmental Management Division. May, 1983. 10pp.

SUMMARY

This report was prepared as part of the "Public Participation Program". Chlorophyll 'a' and Secchi disc results for 1982 were indicative of moderate algae populations and moderate water clarity, on both Florence and Marion Lakes. Trophic state indices (TSI) indicated that Florence Lake was mesotrophic to oligotrophic in character.

REPORT 83-19 Hughes, C. (1983). A Report on the Trophic Status of Pelican Lake. (1979-1982). Environmental Management Division. May, 1983. 12pp.

SUMMARY

This report was prepared as part of the "Public Participation Program". Chlorophyll 'a' and Secchi disc data for 1979 to 1982 were presented. The 1982 chlorophyll and transparency results for 1982 were indicative of nuisance algae populations and low water clarity, respectively. Trophic state indices (TSI) indicated that Pelican Lake was eutrophic in nature.

REPORT 83-20 Hughes, C. (1983). A Report on the Trophic Status of Wanipigow Lake. (1981-1982). Environmental Management Division. May, 1983. 8pp.

SUMMARY

This report was prepared as part of the "Public Participation Program". Chlorophyll 'a' and Secchi disc results for 1982 were indicative of moderately high algae populations and relatively poor water clarity. Trophic state indices (TSI) indicated that Wanipigow Lake was mesotrophic to eutrophic in character.

REPORT 83-21 Hughes, C. (1983). A Report on the Trophic Status of Lake Manitoba. (1980-1982). Environmental Management Division. May, 1983. 8pp.

SUMMARY

This report was prepared as part of the "Public Participation Program". Chlorophyll 'a' and Secchi disc results for 1980 through 1982 were indicative of moderately high algae populations and low water clarity, respectively. Trophic state indices (TSI) indicated that Lake Manitoba is mesotrophic to eutrophic in nature.

REPORT 83-22 Hughes, C. (1983). A Report on the Trophic Status of Setting Lake. (1981-1982). Environmental Management Division. May, 1983. 8pp.

SUMMARY

This report was prepared as part of the "Public Participation Program". Chlorophyll 'a' and Secchi disc results for 1981 and 1982 were indicative of low to moderate algae populations and moderate water clarity, respectively. Trophic state indices (TSI) indicated that Setting Lake was mesotrophic in nature.

REPORT 83-23 Hughes, C. (1983). A Report on the Trophic Status of Metigoshe Lake. (1981-1982). Environmental Management Division. May, 1983. 8pp.

SUMMARY

This report was prepared as part of the "Public Participation Program". Chlorophyll 'a' and Secchi disc results for 1981 and 1982 were indicative of moderate algae populations and good water clarity, respectively. Trophic state indices (TSI) indicated that Metigoshe Lake was mesotrophic to eutrophic in nature.

REPORT 83-24 Hughes, C. (1983). A Report on the Trophic Status of Moose Lake. (1981-1982). Environmental Management Division. May, 1983. 8pp.

SUMMARY

This report was prepared as part of the "Public Participation Program". Chlorophyll 'a' and Secchi disc results for 1981 and 1982 were indicative of low algae populations and good water clarity, respectively. Trophic state indices (TSI) indicated that Moose Lake was mesotrophic to eutrophic in character.

REPORT 83-25. Beck, A. E. (1983). Aquatic Impact Assessment of the Sherridon Mine. Environmental Management Division. November, 1983. 78pp.

SUMMARY

A major copper-zinc mining and milling complex, now abandoned, had been located in the Sherridon area approximately 65 kilometers northeast of Flin Flon. The proximity of the tailings has prompted concerns among residents of the adjacent communities of Cold Lake and Sherridon regarding the integrity of local potable water supply sources. The community of Cold Lake derives its supply from Cold Lake and the community of Sherridon from Sherlett Lake. Concerns were also expressed regarding the impact of tailings drainage upon fish in receiving waters. Responding to these concerns, Water Standards and Studies Section conducted an investigation of the area.

The study area was limited to lakes in the immediate watershed of the tailings site. These included Sherlett Lake (an upstream control), Camp Lake (adjacent to which the tailings are located), and the downstream waters of Cold Lake (the proximal bay of Kississing Lake). Scope of the study was focused on water physicochemistry, sediment metal concentrations and metal levels in the muscle tissue of resident fish species.

Anthropogenic impacts upon Sherlett Lake were not detected. The lake was considered meso-oligotrophic in character and both water physicochemistry and sediment metal concentrations were typical of the geophysical setting. Metal levels in resident fish species were similar to those of Gods Lake, a system generally considered pristine. Sherlett Lake was found to constitute an excellent source of potable water supply.

Camp Lake was severely impacted by leachate and other materials emanating from the tailings site. Symptoms of severe degradation included depressed pH and alkalinity, elevated concentrations of copper and zinc and the virtual absence of macroscopic organisms. The low pH and high concentrations of copper and zinc present in the water column were probably synergistically toxic to fish. The aggregate of all physicochemical factors provided an environment hostile to most macroscopic aquatic life forms.

A small area of Cold Lake immediately downstream of the Camp Lake outfall also showed considerable water quality degradation which again included high zinc concentrations and depressed pH and alkalinity. Although significant iron loading to sediments was observed, the acidic nature of Camp Lake discharges appeared to have leached and transported most other sedimented metals from the immediate area. Conditions were not considered acutely toxic to aquatic biota. However, it was recognized that chronically the plankton and benthic populations could be detrimentally affected and that highly motile organisms such as fish might demonstrate strong avoidance behaviour.

The area of Cold Lake adjacent to the community suffered a lesser degree of water column degradation. Water column zinc concentrations were still significantly greater than background but factors such as pH were not significantly different from Sherlett Lake. The aggregate water quality was considered acceptable for a source of potable water supply. An excellent water quality rating was denied on the basis of aesthetic considerations such as turbidity. Values were within the maximum acceptable range instead of the optimum category. Most sediment metal concentrations, however, were significantly greater in this area than in the immediate vicinity of the Camp Lake outfall. It was thought that the acidic discharges had mobilized sedimented metals from the outfall area and then resedimented them outwards as pH values recovered. This was termed the "wave effect" in an allusion to the groundswell appearance of the observed concentrations. Levels encountered were not considered acutely toxic to benthic organisms.

The Cold Lake fish population appeared considerably reduced in number from the Kississing Lake average. This impact was attributed to selective avoidance of Cold Lake waters which received Camp Lake discharges. Muscle tissue zinc concentrations alone were significantly elevated over background. This, however, could not definitely be proven an effect of zinc loadings via Camp Lake discharges.

It was recognized that continued discharges from Camp Lake would further aggravate deleterious impacts upon the water column, sediments and fish of Cold Lake.

JOINT REPORTS

McEachern, D. B., S. F. Phillips and D. J. Brown. (1983). Status Report, Roblin Forest Products Ltd., Soils and Water Survey. Terrestrial Standards and Studies Report #83-4. Environmental Management Division. July 1983. 14pp.

SUMMARY

Roblin Forest Products Ltd. has been operating a chemical wood treatment plant in Roblin, Manitoba for the past 18 years. Posts and lumber are treated with a water solution of copper - chrome - arsenate (CCA) preservative (trade name - "Timber Specialities C - 50) by injection in pressure cylinders.

A study was conducted to investigate the extent of soil contamination and the possibility of surface water and groundwater contamination by the CCA wood preservative. The study was initiated because preservative solution was observed to be dripping onto the soil at the exits from the treatment cylinders and in the yard where the freshly treated wood was being stored to dry.

Soil was sampled from six locations on the property and at a control site 1.5 km away. Samples from the soil surface and at various depths were analyzed for copper, arsenic and chromium. Significantly elevated levels of copper, arsenic and chromium (100 fold increase over the control) were found in surface soils close to the plant. Concentrations decreased rapidly to background beyond the treated wood storage yard. It appears that contaminants have been contained within the upper 13 cm soil layer which has a high proportion of clay with strong adsorption potential.

Water samples were collected from wells and available surface water both on and adjacent to the company property. Surface water samples were also obtained from the Goose Lakes. Results of the water analyses indicate that arsenic, copper and chromium levels are within acceptable limits. There is no evidence that surface water and groundwater have been contaminated by the wood treatment operation.

There is no indication that precipitation runoff is transporting contaminants from the property but dust re-entrained from the soil surface could pose a human health hazard if inhaled. For this reason, Environment Canada recommends total containment of copper-chrome arsenate wood preservatives.